

TO: Andrew Christensen, Chair, Space Science Advisory Committee

FROM: Jonathan I. Lunine, Chair, Solar System Exploration Subcommittee

SUBJECT: Solar System Exploration Subcommittee Meeting

The Solar System Exploration Subcommittee (SSES) of the Space Science Advisory Committee (SScAC) met October 21-22, 2004 at NASA Headquarters. The purpose of this memorandum is to summarize the findings of that meeting and ask SScAC to consider them and transmit its recommendations to Mr. Andrew Dantzler, Director of the Solar System Exploration.

Administrative changes

SSES welcomes Andrew Dantzler as acting Director of the Solar System Exploration Division, and Doug McCuiston as Director of Mars Exploration. SSES is also extremely pleased that Dr. James Garvin has been named NASA Chief Scientist, indicating the importance the NASA Administrator places on exploration of the solar system. We look forward to working with all of them during these exciting and challenging times.

SSES, in recognizing the organizational transformation currently taking place within NASA, also wishes to express concern about the multitasking of high-level personnel into several duties simultaneously. SSES believes this will lead, sooner or later, to a detrimental stressing of the system, delays in programming, and burnout of personnel. SSES urges that NASA Headquarters fully staff offices at the program level to better meet the needs of the directorates and their customers.

Discovery

Discovery remains the archetypical program of PI-led missions within Solar System Exploration. The return of solar wind samples to the Earth in a crash landing of the Genesis capsule this past September 8 illustrates both the scientific promise and technical/programmatic problems associated with the Discovery Program. SSES was pleased to see the successful launch and initial operations of Messenger on the way to Mercury, as well as the continued nominal operation of Stardust and delivery to the launch site of Deep Impact. However, most of these missions, as well as Kepler now under development, have had significant cost and technical issues, and there have been outright (CONTOUR) and partial (Genesis) technical failures.

SSES is pleased to see that NASA continues to take steps to control cost and reduce risk in the Discovery Program. In particular, the staffing and activation of the new Discovery/New Frontiers Program office at Marshall Space Flight Center is an important step in creating a strong agency managerial presence in this program. We look forward to a dialog with the Program Manager, Todd May, to brief him on our previous Discovery Program findings and discuss his plans for the Program Office.

SSES congratulates NASA on moving forward quickly with selection processes for Discovery missions 11 and 12. We recognize that the timing of the selection process for the following Discovery mission, number 13, may be contingent on the nature of the selections for 11 and 12, as well as budgetary issues with missions currently under development. SSES will revisit these issues in early-to-mid 2005 to assess the ability of the program to control cost and risk, and to maintain the frequent launch rate that is an essential characteristic of the program.

JIMO

The Jupiter Icy Moons Orbiter (JIMO) currently represents the sole focus of NASA Outer Solar System Exploration beyond the Cassini and New Horizons missions. Under the most recent development schedule, the 2021-2022 arrival in the Jupiter system entails a lengthy delay in addressing scientific questions of high scientific priority, most notably the astrobiological potential of Europa.

SSES is increasingly concerned that the JIMO mission design, and the underlying Prometheus power system development, pose a number of very significant technical challenges. At present, the required funding profile to accomplish a JIMO launch by even 2015 with adequate reserves is poorly understood. SSES encourages the most rapid possible determination of the JIMO cost profile, and its endorsement by NASA and the Congress. SSES plans to examine the status of the JIMO mission at its summer 2005 meeting, after the DOE Office of Naval Reactors presents its reactor feasibility study and Northrup Grumman Space Technologies presents its Phase A design.

SSES strongly urges NASA to develop a robust planning effort for the scientific exploration of the outer planets, as a guide to mission design efforts that might utilize Prometheus technologies and more conventional approaches. This will provide a programmatic strategy for outer solar system exploration with the flexibility to implement missions that address high-priority science issues.

Mars

The exploration of Mars has achieved a remarkable and unprecedented level of success over the past year. There are five functioning spacecraft at Mars --Mars Global Surveyor, Odyssey, and ESA's Mars Express in orbit, and the MER Opportunity and Spirit rovers on the surface. The two rovers, Opportunity in particular, have discovered unambiguous evidence that Mars was once wet, with large standing bodies of water, and have far exceeded their designed performance in terms of distance traveled and terrains covered. As was hoped, the MER missions have focused Mars exploration from four original pathways to three over the coming decade, which increases the priority of Mars sample return in 2013. SSES urges the Mars Exploration Program (MEP) Office to move aggressively on advanced planning activities to support missions beyond the 2009 timeframe.

We note that the Mars Exploration Program is one of the crown jewels of NASA. As robotic activities leading to the human exploration of Mars ramp up, we urge NASA not to lose focus on the science goals for Mars exploration. Science missions and human precursor missions should take full advantage of possible synergies between the exploration and science programs.

SSES is pleased by the increasing engagement of the astrobiological community in Mars mission planning and activities, and urges NASA to strongly encourage the involvement of the next generation of astrobiologists in mission planning, development and execution.

Lunar Reconnaissance Orbiter

Although the goals of the Lunar Reconnaissance Orbiter (LRO) are primarily exploration-driven, the SSES recognizes that these goals are also quite relevant to high-priority lunar science. This is especially true of the important issue of the existence and nature of lunar polar volatiles. Therefore, the SSES concludes that the complement of instruments selected for the LRO mission will most likely contribute substantially to lunar science goals. Many important lunar science goals described in the NRC's Solar System Decadal Survey are not explicitly addressed by LRO, and should be addressed by future lunar missions.

Overall, the SSES is pleased with the linkage between the Exploration and Science Mission Directorates as represented by the LRO mission. It is laudable that measurement data from LRO will be archived in the PDS for use by science investigators, in addition to the exploration community. The SSES believes that the goals of future missions within the Robotic Lunar Exploration Program (RLEP) should be explicit about the important ties between lunar exploration and lunar science, as the two are inherently linked. Preserving these ties is vital to the long-term success of LRO and the RLEP.

Planetary Data System

The Planetary Data System (PDS) was established to provide the planetary science community with access to high quality, peer-reviewed datasets, which include calibrations, documentation and other ancillary information. The PDS has experienced difficulties with late deliveries of data products and non-PDS compliant deliveries from flight projects.

SSES commends the PDS efforts to bring products up to compliance and in their efforts to ensure that PDS guidelines are provided in solar system AOs. The SSES was very pleased to see that discussions have begun with the Sample Curation Facility to coordinate archiving of ancillary information related to sample collection in response to our previous recommendations. In response to continued frustrations from the science community with the ease of use of the PDS system and community unhappiness with the management of the system, two evaluations of the PDS Central Node were conducted this past year, and various options are being considered.

SSES strongly supports the idea that the infusion of planetary science understanding in program management is necessary. This could be accomplished either with a scientist high up in the management structure, or with a scientific ombudsman who could act as a liaison between management and the scientific community. There was discussion concerning the purpose of a Central Node in an era of distributed networks, however, the SSES notes that the program office may still have technical functions to fulfill.

New Technology Program

Solar System Exploration Division seeks to develop and validate technologies for broad applicability in future missions. However, flight validation of new technologies is often hampered by the high costs required for stand-alone missions. Feeder programs in the former Code R, that supplied basic technology components, have disappeared. NASA is considering the possibility of using existing spacecraft whose primary missions have been accomplished, but which still have available resources, to help validate new technologies where appropriate (e.g., navigation software). This has been done successfully in the Mars Program, and might be extended to include Discovery and New Frontiers missions.

SSES notes two challenges to this approach. First, while technological objectives are legitimate goals of extended operations for scientific missions, these objectives need to be competed against the potential science that extended missions can return. Ideally, the technology demonstrations would enable or enhance scientific observations and data return in the extended mission. Second, in this era of cost-constrained missions, the technology demonstration requirements need to be fully understood and funded by their sponsors, including the full costs of accommodation on the spacecraft and of impacts on mission operations. Otherwise, the primary phase scientific objectives may be impacted or the technological objectives themselves may be compromised. SSES believes that these challenges can be met and encourages NASA to continue to support new technology efforts essential to accomplish its scientific and exploration goals.

Sincerely

A handwritten signature in black ink, reading "Jonathan I. Lunine". The signature is fluid and cursive, with the first name "Jonathan" and last name "Lunine" clearly distinguishable.

Jonathan I. Lunine, Chair